Application No. 10/034,029
Amdt. Dated 03/18/04
Reply to Office Action of 01/15/2004

IN THE CLAIMS

1. (Currently amended) A method of aligning a sheet material disposed upon a worksurface for enhancing printing or other operations on the sheet material, comprising the steps of:

placing the sheet material over the worksurface;

determining the alignment of the sheet material in a coordinate system having first and second axes for specifying locations relative to the worksurface and the sheet material overlaying the worksurface; and

differentially driving spaced portions of the sheet material for moving the sheet material for providing a selected alignment of the sheet material, said step of differentially driving spaced portions of the sheet material including,

providing a pair of translatable sheet material clamps each extending from a first end to second end and spanning a dimension of the sheet material for clamping and translating the sheet material relative to the worksurface, the first ends mechanically coupled and the second ends mechanically coupled such that the clamps are substantially fixedly spaced along the direction of translation,

clamping the sheet material with at least one of the clamps, and

differentially translating the first and second ends of the clamps.

2. (Original) The method of claim 1 wherein the step of placing the sheet material over the worksurface includes the step of placing the sheet material over a flat worksurface.

3. (Original) The method of claim 1 wherein the step of placing the sheet material over the worksurface includes placing the sheet material over a cylindrical worksurface.

4. (Original) The method of claim 1 wherein the step of determining the alignment of the sheet material includes determining the skew of the printing sheet, and wherein the step of differentially driving spaced portions for providing a selected alignment includes differentially driving for providing a selected skew of the printing sheet.

5. (Original) The method of claim 1 wherein the step of determining the alignment of the sheet material includes determining the distance of a selected location on an edge of the sheet material from a selected location in the coordinate system, and wherein the step of differentially driving spaced portions of the sheet material for moving the sheet material for providing a selected alignment includes differentially driving spaced portions that the selected location on the edge of the sheet material is within a selected distance of the selected in the coordinate system.

6. (Cancelled)

7. (Currently amended) The method of claim [[6]] 1 wherein the step of providing the pair of translatable clamps includes providing a pair of magnetic bar clamps each having a top portion housing a plurality of electrical coils and a magnetic keeper portion for clamping the sheet material between the keeper and the top portion.

8. (Currently amended) The method of claim [[6]] 1 wherein the step of placing the sheet material over the worksurface includes placing the sheet material over a flat worksurface.

9. (Cancelled)

10. (Previously amended) The method of claim 1 wherein the step of determining the alignment of the sheet material includes:

providing a sensor translatable along one of the axes;

translating the sensor across the edge of the sheet material and sensing a first location of the edge;

translating the sheet material a known distance along the other of the axes;

translating the sensor across the edge of the sheet material and sensing a second location of the edge of the sheet; and

determining the skew of the sheet material from the difference between the first and second locations of the edge and a known translation distance.

11. (Original) The method of claim 10 wherein the step of providing a sensor includes providing an optical sensor for transmitting a beam and receiving light from the reflection of the transmitted beam.

12. (Original) The method of claim 11 including the step of providing a reflective material under the sheet material for enhancing the difference in reflected light as the sensor is translated across the edge of the sheet material.

13. (Original) The method of claim 1 wherein the step of determining alignment of the sheet material includes:

providing a sensor mounted with the worksurface and including an array of pixels extending in the direction of one of the axes;

providing a light source for illuminating the sensor;

sensing a first location in the direction of the one of the axes of the edge of the sheet material with the sensor;

translating the sheet material a known distance along the other of the axes;

sensing a second location in the direction of the one of the axes of the edge of the sheet material with the sensor; and

determining the skew of the sheet material from the difference between the first and second locations of the edge and the known translation distance.

14. (Original) The method of claim 1 including, subsequent to the step of differentially driving space portion to provide a selected alignment , the steps of:

determining the residual skew of the sheet material; and

translating the sheet material for printing thereon, the step of translating including steering the material so as to maintain the residual skew of the sheet material.

15. (Original) The method of claim 14 wherein the step of steering includes repeatedly determining the skew of the sheet material so as monitor the residual skew, and differentially driving the left and right actuators as necessary to maintain the residual skew.

16. (Currently amended) An apparatus for supporting a sheet material on a worksurface with a selected alignment and for performing work operations on the sheet material responsive to a controller, comprising:

a workbed providing the worksurface for supporting the sheet material, the worksurface containing a workhead axis and a sheet material translation axis perpendicular to the workhead axis;

a workhead for performing the work operation upon the sheet material, said workhead being translatable parallel to the work axis for printing on the sheet material;

means for securing the sheet material to the worksurface when working of the sheet material and for releasing the sheet material from the worksurface when translating the sheet material;

sensing means for sensing an edge of the sheet material; and

sheet material translation means for translating the sheet material in the direction of the sheet material translation axis, said sheet material translation means including means for differentially driving space portions of the sheet material, responsive to said sensing means, for providing a selected alignment of the sheet material relative to the worksurface;

wherein said sheet material translation means includes a pair of translatable clamps each movable between clamped and unclamped conditions relative to the sheet material supported on said worksurface and extending across the worksurface

from a first end to second end and parallel to the work axis for translating the sheet material in the direction of the sheet material translation axis, the first ends being mechanically coupled to one another and the second ends being mechanically coupled to one another such that the clamps are substantially fixedly spaced from one another in the direction of the sheet material translation axis; and

wherein said means for differentially driving spaced portions includes first and second actuators, coupled to the first and second ends, respectively, of said clamp pair, for independently translating the first and second ends of the clamp pair in the direction of the sheet material translation axis.

17. (Cancelled)

18. (Cancelled)

19. (Original) The apparatus of claim 16 wherein said sensing means includes a sensor mounted with said workhead for translation with said workhead in the direction of the work axis.

20. (Original) An apparatus for supporting a sheet material on a worksurface with a selected alignment for performing work operations on the sheet material, comprising:

a workbed for providing the worksurface for supporting the sheet material, said worksurface containing a work axis and sheet material translation axis perpendicular to the work axis;

sheet material translation means for translating the sheet material in the direction of the sheet material translation axis;

a workhead for performing the work operations upon the sheet material, the workhead being translatable parallel to the work axis;

means for securing the sheet material to the worksurface when printing on the sheet material and releasing the sheet material from the worksurface when translating the sheet material;

an edge sensor for sensing an edge of the sheet material, said sensor mounted with the workhead for translation therewith in the direction of the work axis;

a controller in communication with said workhead, said sheet material translation means and said edge sensor for controlling the work operation on the sheet material responsive to data stored in a memory, and wherein

said controller includes programming, stored in a memory associated therewith, for determining the alignment of the sheet material, said programming including instructions for the following: translating the workhead in the direction of the work axis and past the edge of the sheet; receiving a first communication from the edge sensor responsive to the location of the edge of the sheet material in the direction of the work axis; energizing the sheet material translation means for translating the sheet material a known distance in the direction of the sheet material translation axis; translating the workhead in the direction of the work axis and past the edge of the sheet; receiving a second communication from the edge sensor responsive to the location of the edge of the sheet material in the direction of the work axis; and determining the skew of the sheet material responsive to said first and second communications and said known translation distance.

21. (Original) The apparatus of claim 20 wherein said sheet material translation means includes first and second independent actuators in communication with said controller, and wherein said controller, responsive to the determination of the skew, controls said first and second actuators so as to provide a selected skew of the sheet material.

22. (Original) The apparatus of claim 21 including a position sensor in communication with the controller and for providing a signal responsive to the position of said sensor in the direction of the work axis, and wherein said controller, responsive to at least one of the first and second communications and to said signal from said position sensor instructs said first and second actuators for varying the location of the edge of the sheet material in the direction of the work axis.

23. (Original) The apparatus of claim 22 wherein said sheet material translation means includes a pair of translatable clamps each movable between clamped and unclamped conditions relative to the sheet material supported on said worksurface and extending from a first end to second end across the worksurface and parallel to the work axis for translating the sheet material in the direction of the sheet material translation axis, the first ends being mechanically coupled to one another and the second ends being mechanically coupled to one another such that the clamps are substantially fixedly spaced from one another in the direction of the sheet material translation axis; and wherein said first and second actuators, are coupled to the first and second ends, respectively, of said clamp pair.

24. (Original) The apparatus of claim 21 wherein said sheet material translation means includes first and second friction wheels spaced apart from one another along the direction of the work axis and disposed for contacting the sheet material, and wherein said first and second actuators are coupled to the first and second friction wheels for rotating said first and second friction wheels, respectively.

25. (Cancelled)

26. (New) A method of aligning a sheet material disposed upon a worksurface for enhancing printing or other operations on the sheet material, comprising the steps of:

placing the sheet material over the worksurface;

determining the alignment of the sheet material in a coordinate system having first and second axes for specifying locations relative to the worksurface and the sheet material overlaying the worksurface; and

differentially driving spaced portions of the sheet material for moving the sheet material for providing a selected alignment of the sheet material;

wherein the step of determining the alignment of the sheet material includes,

providing a sensor translatable along one of the axes by providing an optical sensor for transmitting a beam and receiving light from the reflection of the transmitted beam and providing a reflective material under the sheet

material for enhancing the difference in reflected light as the sensor is translated;

translating the sensor across an edge of the sheet material and sensing a first location of the edge;

translating the sheet material a known distance along the other of the axes;

translating the sensor across the edge of the sheet material and sensing a second location of the edge of the sheet; and

determining the skew of the sheet material from the difference between the first and second locations of the edge and a known translation distance.